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(56) References cited:
EP-A- 0 095 780
EP-A- 0 136 563
EP-A- 0 172 999
DE-A- 2 822 058
DE-B- 2 818 198
DE-U- 1 878 297
DE-U- 1 933 472
US-A- 4 269 432
US-A- 4 621 830

AUTOMOTIVE ENGINEERING, vol. 93, no. 11, November 1985, pages 83-90, Dallas, Texas, USA; "New sports car features variable-geometry turbocharger and toe-control, camber-compensating suspension"

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Description

The present invention relates to a vehicle suspension system accoring to the first part of the main claim.

Various types of vehicle suspension system have been proposed for supporting wheels on the vehicle body, one of which is provided with a suspension member extending in the longitudinal direction of the vehicle body and supporting a wheel on the vehicle body. This type of suspension member includes a trailing arm or a leading arm. For example, in the trailing-arm type suspension, the trailing arm is disposed in front of the wheel and extends in the longitudinal direction of the vehicle body with its front end pivotally connected to the vehicle body and its rear end pivotally connected to a wheel support member, by which a wheel is supported swingably on the vehicle body. As the main means for providing the trailing arm with a resilient supporting characteristic in the longitudinal direction, a rubber bush means is interposed as a resilient means in each of the connecting portions of the trailing arm. If the rubber is soft and produces a large amount of deformation with respect to a longitudinal force applied thereto, the shock due to the application of longitudinal force via the wheel can be largely absorbed by the bush and the riding comfort can be improved. However, in case that the bush is deformed too much, the toe angle of the wheel tends to change excessively, which adversely affects the motive stability and drivability of the vehicle.

Accordingly, the trailing arm system is typically set such that it exhibits a resiliently soft characteristic with respect to a rearward force acting on the wheel caused by the driving resistance while it exhibits a resiliently hard characteristic with respect to a frontward force acting thereon. Japanese Utility Model Public Disclosure No. 139040/1981 discloses this type of trailing arm system, in which a trailing arm extending frontward with respect to a vehicle body is connected at ends to the vehicle body and a wheel via specially designed rubber bushes, respectively. These rubber bushes provide the trailing arm system with the above-mentioned resilient characteristics.

Shock absorbing means is also provided in a conventional vehicle suspension system. Recently, a proposal has been made to use a shock absorbing member such as a damper and a spring means wherein such member is arranged so as to incline rearward for the purpose of lowering the bonn t of the vehicle body to obtain a better frontward view through the windshield or of obtaining a larger amount of room in the rear portion of the passenger compartment. In operation, upward forces acting on the wheel from the road surface, which are caused by the uneveness of the surface, are applied to the connecting end of the inclined shock absorbing member from the wheel side. Due to the inclination of the member, the reaction force in response to the upward force acts on the wheel in the inclined direction. This inclined reaction force presses the wheel in both downward and forward directions at the same time. Where the wheel is supported by the trailling arm system having a resiliently hard characteristic with respect to the forward force, the forward component of the reaction force may not be absorbed by the trailing arm system an a shock may be produced by that component. However, no proposal has been made in the prior art for improving the riding comfort of this type of suspension system with an inclined shock absorbing member.

A vehicle suspension system according the first part of the main claim is known from EP-A-0 095 780. The resilient characteristics of the rubber bush assembly is equal in each direction of the horizontal component of the reaction force.

From DE-U-18 78 297 a resilient means is known which has a high spring constant in radial direction and a low spring constant in axial direction. This known resilient means has a resilient characteristics bein set to exhibit soft resilience against an axial force and to exhibit a hard resilience against the radial force.

DE-U-19 33 472 shows a resilient means with 3 ribs. This results in a different resilient characteristics of this resilient means depending on the mounting direction of the resilient means.

From EP-A-0 172 999 a resilient means of a trailing arm suspension system is known which has a total differnt function because this known vehicle suspension system has no horizontal component of the reaction force acting on the suspension member.

It is the object of the present invention to provide a vehicle suspension system according the first part of the main claim which provides an improved vehicle riding comfort with respect to upward force applied on the shock absorbing means from the wheel side.

To accomplish above obve objects, a vehicle suspension system of the present invention having a suspension means arranged generally in the longitudinal direction of the vehicle body for controlling the movement of the wheel in the longitudinal direction comprises a shock absorbing means disposed between the wheel and the vehicle body and inclin d with respect to the vertical direction which exerts reaction forces for suppressing the upward movement of the wheel, and a resilient means defining the resilient characteristic of said suspension member in th longitudinal direction of the vehicle body, said resili nt characteristic being set

such that it exhibits soft resilience against the horizontal component of said reaction force exerted from said inclined shock absorbing means while it exhibits hard resilience against force in the opposite direction to said horizontal component of the reaction force.

In a preferred embodiment of the present invention, the suspension system may be of a trailing-arm type which includes a trailing arm disposed in front of the wheel and is pivotally connected to the vehicle body at the forward end and to a wheel support for supporting the wheel rotatably at rearward end. The shock absorbing means can be a spring means which exerts a reaction force in response to the amount of movement of the wheel in the longitudinal direction. Alternatively, it can be a damper means which exerts a reaction force in response to the speed of movement of the wheel in the longitudinal direction. The resilient means includes bushing means provided on the ends of the suspension member extending longitudinally. The bushing means may be comprised of an outer tube, an inner tube and a resilient bushing therebetween. A desired resilient characteristic of this type can be obtained by the provision of a void or a hard portion in the resilient bushing.

According to the present invention, since the shock absorbing means is disposed inclined forwardly or rearwardly, an upward force applied to the wheel from an uneven road surface causes the shock absorbing means to exert a reaction force along the inclined direction, which acts on the wheel to force it in both the downward and longitudinal directions of the vehicle body. Namely, the horizontal force element of the reaction force acts on the wheel side, and so acts on the suspension member. The resilient characteristic of this suspension member is defined by the resilient means which is resiliently soft in the direction of the horizontal force element of the reaction force. Thus, the suspension means resiliently deformed sufficiently to prevent the shock caused by the application of the horizontal force element of the reaction force from reaching the vehicle. Therefore, the riding comfort of the vehicle having a suspension system which includes an inclined shock absorbing means can be improved. On the contrary, the resilient characteristic of the suspension means is hard in the opposite direction to the horizontal force element. Therefore, in this direction, the change in the wheel attitude can be suppressed to thereby improve the riding qualities and the drivability of the vehicle.

In another aspect of the present invention, there is provided a rear suspension system of a vehicle which includes a trailing arm member as a suspension member arranged generally in the longitudinal direction of the vehicle body for controlling the movement of the wheel in the longitudinal direction. The suspension system includes a strut-type shock absorbing means disposed between the wheel and the vehicle body and comprises a damper member and a spring member disposed coaxially around the damper member. The shock absorbing means is arranged to incline rearwardly so that its upper end is located to the rear side compared to its lower end, and is connected to the vehicle body at the upper end and to the wheel support member for rotatably supporting the wheel at the lower end, which forms a strut. The shock absorbing means of strut type exserts reaction forces for suppressing the upward movement of the wheel. A resilient means is provided for defining the resilient characteristic of the trailing arm. The resilient characteristic is determined such that it exhibits soft resilience against the horizontally forwardly acting component of said reaction force exserted from said inclined shock absorbing means while it exhibits hard resilience against force in the opposite direction to the horizontal component of the reaction force. Further, a pair of front and rear lateral link members are disposed in the lateral direction of the vehicle body between the wheel and the vehicle body. Each outward end of the lateral links is pivotally connected to the wheel support whereas each inward end thereof is pivotally connected to the vehicle body.

Other objects and advantages of the present invention will be apparent upon reading the following detailed description with reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partial front view of an example of a rear suspension system of strut type in accordance with the present invention which is incorporated with a front-engine, front drive type vehicle;

Figure 2 is a plan view of the rear suspension system shown in Figure 1;

Figure 3 is a left side view of the rear suspension system shown in Figure 1;

Figure 4 is a partial perspective view of a trailing arm member used in the rear suspension system shown in Figure 1;

Figure 5 is a side view of the trailing arm member shown in Figure 4;

Figure 6 is a sectional view of the trailing arm member taken along the line VI-VI shown in Figure 5;

Figure 7 shown resilient charact ristic lines of the trailing arm member shown in Figure 1 in the longitudinal direction of the vehicle body;

Figure 8 shows a reaction force exerted from the strut of the rear suspension system shown in Figure 1 when the wheel passes over a projection on the road surface and an upward force caused by that projection acts on the lower end of the strut from the wheel;

Figure 9 shows an example of resilient means in the form of a rubber bush which is disposed on both ends of a trailing arm member;

Figure 10 is a cross-sectional view of the rubber bush shown in Figure 9 taken along the line X-X in Figure 9;

Figure 11 shows another example of the rubber bush which is disposed on both end of a trailing arm member;

Figure 12 is a cross-sectional view of the rubber bush shown in Figure 11 taken along the line XII-XII in Figure 11;

Figure 13 shows another example of the rubber bush which is disposed on both ends of a trailing arm member;

Figure 14 is a cross-sectional view of the rubber bush shown in Figure 13 taken along the line XVI-XVI in Figure 13;

Figure 15 shows another strut-type suspension system having a trailing arm member with the rearward end attached to a wheel hub, to which the present invention can be applied;

Figure 16 shows an example of a suspension system of double wishbone type, to which the present invention can be applied.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While the present invention will be described in connection with preferred embodiments, it will be understood that we do not intend to limit the invention to these embodiments. On the contrary, we intend to cover all alternatives, modifications, and equivalents as may be included within the sprit and scope of the invention as defined by the attached claims.

Referring now to the drawings, especially to Figure 1, there is illustrated an example of a strut-type rear suspension system according to the present invention, which is applied to the rear wheels of a front-engine, front-drive type vehicle. The right and left side suspension systems for the right and left wheels have the same construction and in the following description will be made only as to the left suspension system. In the drawings, the same elements of the right suspension system as those of the left one are denoted by the same numerals.

In figures 1 and 2, a vehicle body 1 is provided with a rear sub-frame 1a mounted thereon at the rear side and extending in the lateral direction of the vehicle body. A strut-type rear suspension system 2 for the left-side rear wheel 1b is supported by the sub-frame 1a. The suspension system 2 supports a wheel hub member 3 for rotatably supporting the rear wheel 1b. The suspension system 2 includes a pair of lateral links 4a, 4b extending laterally, a trailing arm member 5 extending in the longitudinal direction of the vehicle body 1, and a shock absorbing member 6. As best shown in Figure 3, the shock absording member 6 is arranged to be inclined with respect to the vertical so that the upper end is located rearward to the lower end. The pair of lateral links comprises front and rear leteral links 4a and 4b. The front lateral link 4a is swingably connected at its inner end to a spindle 7 via a bush means 7a. The spindle 7a is attached to the front side of the sub-frame 1a and arranged longitudinally to form a rotational axis for the bush means 7a. Likewise, the rear lateral link 4b is swingably connected at its inner end to a spindle 8 of the sub-frame 1a via a bush means 8a. The front side of the wheel hub 3 is provided with A spindle 9, to which the outer end of the front lateral link 4a is swingable connected via a bush means 9a. A spindle 10 is also provided on the rear side of the wheel hub 3 and the outer end of the rear lateral link 4b is swingably connected thereto via a bush means 10a. The wheel hub 3 is also provided at its outer side with a spindle 11 projecting laterally and outwardly, around which the rear left wheel 1b is rotatably supported. As shown in Figures 1 and 3, the shock absorbing member 6 is connected at its lower end with the upper portion of the wheel hub 3, and is pivotally connected at its upper end to the vehicle body 1. The shock absorbing member 6 comprises a damper 6a and a spring 6b disposed around the damper 6a. As described above, the shock absorbing member 6 is inclined rearward so that more interior space is available at the rear of the vehicle.

The wheel hub 3 is provided at its inner side with another spindle 12 projecting laterally inwardly. The trailing arm 5 is pivotally connected at its rear end with the spindle 12 via a bushing means 5a, whereas it is pivotally connected at its front end with a spindle 13 via a bushing means 5b. The spindle 13 is mounted on a rear side frame 1c of the vehicle body 1.

Referring to Figures 4 to 6, the rear bushing means 5a comprises a metalic outer tube 51 formed on the rear end of the trailing arm 5, a metalic inner tube 52 rotatably mounted on the spindle 12, and a tubular rubber bushing 53 firmly inserted therebetween. The rubber bushing 53 has the same rsilient characteristics with respect to forward and rearward forces. The front rubber bushing means 5b comprises a metalic outer tube 54 formed on the front end of the trailing arm 5, an

inner tube 55 rotatably mounted on the spindle 13, and a tubular rubber bushing 56 firmly inserted therebetween. The rubber bushing 56 is formed therein with an arcuate void 56a extending axially at its rear side with respect to the inner tube 55. In the opposite side of the rubber bushing 56, namely in the front side portion thereof with respect to the inner tube 55, there is formed a protruding portion 56b projecting frontwardly, the top portion of which is forced to be in contact with the inner surface of the outer tube 54 in a pre-compressed condition. Further, the inner tube 55 is formed at its axially central portion with an annular knot portion 55a extending about the surface thereof in order to prevent the rubber bushing from becoming apart from the inner tube 55.

The operation of the suspension system, mainly of the trailing arm 5 in connection with Figure 7 and 8, there will now be described. As shown in Figure 8, when the rear wheel 1b passes over a projection on the road surface, an upward force b is applied to the wheel 1b from the road surface. This upward force is transferred to the lower end of the shock absorber 6 from the wheel hub 3. Since the shock absorber 6 is inclined rearward, a reaction force d against the upward acts on the wheel hub 3 at an angle. Therefore, there appear the horizontal and vertical components f and e of the reaction force, and that horizontal component is applied to the trailing arm 5 as a frontward force. Due to the front bushing means 5b, the trailing arm 5 exhibits a resilient characteristic line l such as shown in Figure 7 which shows relationship between displacement of the trailing arm 5 and the longitudnal force acting on the trailing arm. More specifically, since the protrusion 56b of the rubber bushing 56 is in contact with the inner surface of the outer tube 54 under pre-compression, the rubber bushing 56 exhibits a hard resilient characteristic with respect to the frontward force f until the protrusion is out of contact with the inner surface of the outer tube 54, which condition is represented by the point p on the line l. After the protrusion 56b separates from the inner surface, due to the arcuate void 56a, the rubber bushing 56 is deformed with less amount of force compared to the solid one and exhibits a resiliently softer characteristic than before. According, the shock due to the frontward force can be avoided and the riding qualities can be improved. After the void has collapsed, the rubber bushing again exhibits a resiliently hard characteristic.

In the embodiment, considering that the frontward force is acting on the trailing arm 5 due to the weight of the vehicle body 1, the amount of pre-compression induced into the rubber bushing 56 is determined so that th condition repr sented by the bending point p is reached under th application of only the horizontal component of the vehicle-body weight to the trailing arm 5. By this configuration, the trailing arm 5 exhibits a desired resiliently soft characteristic with respect the frontward component of the upward force, which is distinguishable from that obtained under the application of rearward force.

While, when the rearward force is applied to the trailing arm 5, the rubber bushing 56 exhibits a resilient characteristic as shown by the line k, which resembles that obtained by a solid rubber bushing. This resilient characteristic k is harder that that shown by the line l especially from the bending point p to the callapse of the void 56a. Therefore, wheel supported by the trailing arm 5 is suppressed in its rearward travel caused by the rearward force and in its toe change. Hence, the motive stability and the drivability of the vehicle can be improved.

In the above embodiment, the resilient characteristic has a bending point p with respect to the frontward force f because of the provision of the pre-compressed protrusion in the rubber bushing, and is the same characteristic as that with respect to the rearward force up to the bending point p. Alternatively, the trailing arm 5 can be such that it exhibits different resilient characteristics with respect to the frontward and rearward forces throughout all conditions. These kinds of resilient characteristics can be obtained by modifying the configuration of the bushing means 5a or 5b. Typical examples of the bushing means will be explained below.

Figures 9 and 10 show an example of the bushing means. This bushing means 20 comprises an outer tube 21 formed on the front end of the trailing arm 5, an inner tube 22 rotatably supported about the spindle 13, and a tubular rubber bushing 23 firmly therebetween. An arcuate void 24 is formed between the outer surface of the rubber bushing 23 and the inner surface of the outer tube 21 at the rearward portion with respect to the inner tube 22 and extends axially. In the opposite side portion, namely in the frontward portion of the rubber bushing 23 with repect to the inner tube 22, an arcuate plate 25 is disposed which extends axially and is resiliently hard compared to the rubber bushing 23. The trailing arm having this bushing means 20 on the front end and the normal bushing means 5a on the rear end exhibits a resiliently soft characteristic with respect to the frontward force until the void 24 collapsed. Whereas, it exhibits a resiliently hard characteristic with respect to th r arward force due to the provision of hard plate 25.

Figures 11 and 12 show another example of the bushing means. The bushing means 30 has the same configuration as the above bushing means 20

except for a rubber bushing 33. The rubber bushing 33 is resiliently hard and is formed therein with an arcuate groove 34 extending axially in its rearward portion with respect to the inner tube 32. The arcuate groove 34 defines an arcuate void with th inner surface of the outer tube 31. Accordingly, the bushing means 30 exhibits a resiliently soft characteristic with respect to the frontward force until the void collapses, while it exhibits a resiliently hard characteristic with respect to the rearward force.

Figures 13 and 14 show still another example of the bushing means. This bushing means 40 has the same configuration as the bushing means 20 except for a rubber bushing 43. The rubber bushing 43 is resiliently soft and is inserted therein with an arcuate plate 45 extending axially at the front side portion thereof with respect to the inner tube 42. The arcuate plate 45 is resiliently harder than the rubber bushing 43. Due to the arcuate plate 45, the bushing means 40 exhibits a resiliently harder characteristic with respect to the rearward force.

In the above examples, the resilient characteristics of the trailing arm are defined by modifying the front bushing means 5b on the trailing arm. Alternatively, the rear bushing means 5a or both of front and rear bushing means can be modified to obtain desired resilient characteristics. Or a trailing arm can be divided into front and rear portions and a bushing means can be interposed between them. By modifying the resilient characteristic of the interposed bushing means, desired resilient characteristics of the trailing arm can be obtained.

The present invention can be adopted to other suspension systems so long as it is provided with a longitudinally extending suspension member such as a trailing arm and an inclined shock absorber producing a horizontal force element acting on the longitudinally extending suspension. An example of this type of suspension system is shown in Figure 15. This suspension system has the same configuration as the above-mentioned suspension system 2 except that the trailing arm 5 is firmly connected at its rear end to the wheel hub 3 and an upper control lateral link 60 is provided for controlling the attitude of the wheel 1b. Another example of the suspension is shown in Figure 16, which is of the double wishbone type and includes a pair of lower lateral links 71a, 71b and an A-shaped upper lateral link 72 for controlling the attitude of the wheel 1c, as is known.

Claims

1. A vehicle suspension system which has a suspension member (5) arranged generally in the longitudinal direction of the vehicle body for controlling the longitudinal displacement of a wheel (1b) comprising a shock absorbing means (6) disposed between the wheel (1b) and the vehicle body for exerting a reaction force to suppress the upward movement of the wheel (1b) which is arranged to incline longitudinally with respect to the vertical so that it produces a horizontal component of said reaction force acting on said suspension member (5), and a resilient means (56) defining the resilient characteristics of said suspension member (5) in the longitutinal direction,
characterized in that
said resilient characteristics being set to exhibit soft resilience against the horizontal component of said reaction force exerted from said inclined shock absorbing means and to exhibit hard resilience against force in the opposite direction to said horizontal component of the reaction force.

2. The vehicle suspension system according to claim 1, wherein said suspension system (2) is for supporting a rear wheel (1b).

3. The vehicle suspension system according to claim 1 or 2, wherein said suspension member is a trailing arm (5) disposed in front of the wheel (1b) and is pivotally connected to the vehicle body (1) at a forward end and to a wheel support member for supporting the wheel (1b) rotatably at a rearward end.

4. The vehicle suspension system according to one of the claims 1 to 3, wherein said shock absorbing means (6) includes a spring means (6b) which exerts a reaction force in response to the amount of movement of the wheel (1b) in the vertical direction.

5. The vehicle suspension system according to one of the claims 1 to 4, wherein said shock absorbing means (6) includes a damper means (6a) which exerts a reaction force in response to the speed of movement of the wheel (1b) in the vertical direction.

6. The vehicle suspension system according to claim 5, wherein said suspension system is of a strut type and a strut member thereof is defined by said damper means (6a) which is firmly attached at its lower end to a wheel support (3) for supporting the wheel (1b) rotatably and is support d at its upper end on the vehicle body (1).

7. The vehicle suspension system according to one of the claims 1-6, further comprising a pair of front and rear lateral link members (4a, 4b);

each of which is pivotally connected to the vehicle body (1) at its laterally inner end and to a wheel support (3) for supporting the wheel (1b) rotatably at its laterally outer end.

8. The vehicle suspension system according to one of the claims 1-7, further comprising a pair of upper and lower link members for controlling the camber of the wheel (1b).

9. The vehicle suspension system according to one of the claims 1-8, wherein said resilient means includes a resilient bushing means (56) provided at least on one end of said suspension member (5).

10. The vehicle suspension system according to claim 9, wherein said resilient bushing means (56) is interposed between an outer tube (54) formed on one of said suspension member and an inner tube (55) supported on the vehicle body or a wheel support for supporting the wheel rotatably.

11. The vehicle suspension system according to claim 10, wherein said resilient bushing means (56) is provided with a void (56a) for obtaining said resilient characteristics.

12. The vehicle suspension system according to claim 10, wherein said resilient bushing means (43) is provided therein with an inserted member (45) which is resiliently harder that the resilient bushing means itself so as to obtain said resilient characteristics.

13. The vehicle suspension system according to claim 10, where said resilient bushing means (56) is formed on its outer surface with a protusion (56b) which is in contact with the inner surface of said outer tube with predetermined pressure to thereby obtain said resilient characteristics.

Patentansprüche

1. Fahrzeugradaufhängung, die ein Aufhängungselement (5) besitzt, das im allgmeinen in Längsrichtung des Fahrzeugaufbaus zur Steuerung der Längsverschiebung eines Rades (1b) angeordnet ist, umfassend eine Stoßdämpfungseinrichtung (6), die zwischen dem Rad (1b) und dem Fahrzeugaufbau angeordnet ist, um eine Reaktionskraft zur Unterdrückung der Aufwärtsbewegung des Rades (1b) auszuüben, und die in Längsrichtung zur Vertikalen geneigt angeordnet ist, so daß sie eine horizontale Komponente der Reaktionskraft rzeugt, die auf das Aufhängungselement (5) wirkt, sowie eine Federungseinrichtung (56), die die Federkennlinie des Aufhängungselementes (5) in Längsrichtung bestimmt,
dadurch gekennzeichnet,
daß die Federkennlinie so eingestellt ist, daß ein weiches Abfedern der horizontalen Komponente der von der Stoßdämpfungseinrichtung ausgeübten Reaktionskraft erreicht wird, und daß ein hartes Abfedern der Kraft in entgegengesetzter Richtung zu der horizontalen Komponente der Reaktionskraft erreicht wird.

2. Fahrzeugradaufhängung nach Anspruch 1, dadurch gekennzeichnet, daß die Fahrzeugradaufhängung (2) ein Hinterrad (1b) abstützt.

3. Fahrzeugradaufhängung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das Aufhängungselement ein Längslenker (5) ist, der vor dem Rad (1b) angeordnet ist und an einem vorderen Ende an dem Fahrzeugaufbau (1) angelenkt ist und an einem hinteren Ende zur Abstützung des Rades (1b) drehbar in einem Radhalteelement gelagert ist.

4. Fahrzeugradaufhängung nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Stoßdämpfungseinrichtung (6) eine Federeinrichtung (6b) umfaßt, die als Reaktion auf die Bewegung des Rades (1b) in vertikaler Richtung eine Reaktionskraft ausübt.

5. Fahrzeugradaufhängung nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß die Stoßdämpfungseinrichtung (6) eine Dämpfungseinrichtung (6a) umfaßt, die als Reaktion auf die Bewegungsgeschwindigkeit des Rades (1b) in vertikaler Richtung eine Reaktionskraft ausübt.

6. Fahrzeugradaufhängung nach Anspruch 5, dadurch gekennzeichnet, daß die Fahrzeugradaufhängung ein Federbein ist, und daß ein Federbeinelement durch die Dämpfungseinrichtung (6a) gebildet wird, die an ihrem unteren Ende fest an einer Radhalterung (3) zur drehbaren Lagerung des Rades (1b) angebracht ist und sich an ihrem oberen Ende am Fahrzeugaufbau (1) abstützt.

7. Fahrzeugradaufhängung nach einem der Ansprüch 1 bis 6, ferner umfassend ein Paar vordere und hintere s itliche Verbindungselemente (4a, 4b), die jeweils an ihrem in Querrichtung inneren Ende am Fahrzeugaufbau (1) angelenkt sind, und an ihrem in Querrichtung äußer n Ende zur Abstützung des Rades (1b)

drehbar mit einer Radhalterung (3) verbunden sind.

8. Fahrzeugradaufhängung nach einem der Ansprüche 1 bis 7, ferner umfassend ein Paar obere und untere Verbindungselemente, die den Sturz des Rades (1b) steuern.

9. Fahrzeugradaufhängung nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Federungseinrichtung eine Federbuchseneinrichtung (56) umfaßt, die an mindestens einem Ende des Aufhängungslementes (5) vorgesehen ist.

10. Fahrzeugradaufhängung nach Anspruch 9, dadurch gekennzeichnet, daß die Federbuchseneinrichtung (56) zwischen einem äußeren Rohr (54), das an einem der Aufhängungselemente ausgebildet ist, und einem inneren Rohr (55) angeordnet ist, das an dem Fahrzeugaufbau oder an einer Radhalterung angebracht ist, in der das Rad drehbar gelagert ist.

11. Fahrzeugradaufhängung nach Anspruch 10, dadurch gekennzeichnet, daß die Federbuchseneinrichtung (56) mit einem Hohlraum (56a) versehen ist, um die Federkennlinie zu erreichen.

12. Fahrzeugradaufhängung nach Anspruch 10, dadurch gekennzeichnet, daß die Federbuchseneinrichtung (43) innen ein Einsatzelement (45) aufweist, das härter gefedert ist als die Federbuchseneinrichtung selbst, um die Federkennlinie zu erreichen.

13. Fahrzeugradaufhängung nach Anspruch 10, dadurch gekennzeichnet, daß die Federbuchseneinrichtung (56) an ihrer Außenfläche einen Vorsprung (56b) aufweist, der mit einem vorbestimmten Druck gegen die Innenfläche des äußeren Rohres drückt, um dadurch die genannte Federkennlinie zu erreichen.

Revendications

1. Suspension pour véhicule, comportant un organe de suspension (5) disposé de façon générale dans la direction longitudinale du châssis du véhicule et destiné à régler le déplacement longitudinal d'une roue (1b), comprenant un dispositif amortisseur de chocs (6) placé entre la roue (1b) et le châssis du véhicule et destiné à appliquer une force de réaction s'opposant au déplacement vers le haut de la roue (1b), le dispositif amortisseur de chocs étant disposé afin qu'il soit incliné longitudinalement par rapport à la verticale si bien qu'il crée une composante horizontale de la force de réaction agissant sur l'organe de suspension (5), et un dispositif élastique (56) déterminant les caractéristiques élastiques de l'organe de suspension (5) dans la direction longitudinale,
caractérisée en ce que
les caractéristiques élastiques sont réglées afin qu'elles donnent une élasticité souple en présence d'une composante horizontale de la force de réaction appliquée par le dispositif incliné amortisseur de chocs et une élasticité dure en présence d'une force de sens opposé à la composante horizontale de la force de réaction.

2. Suspension pour véhicule selon la revendication 1, dans laquelle la suspension (2) est destinée à supporter une roue arrière (1b).

3. Suspension pour véhicule selon la revendication 1 ou 2, dans laquelle l'organe de suspension est un bras (5) tourné vers l'arrière, placé en avant de la roue (1b) et raccordé de manière articulée au châssis (1) du véhicule à une extrémité avant et à un organe de support de la roue (1b) afin que celle-ci puisse tourner à une extrémité tournée vers l'arrière.

4. Suspension pour véhicule selon l'une des revendications 1 à 3, dans laquelle le dispositif amortisseur de chocs (6) comporte un dispositif à ressort (6b) qui exerce une force de réaction en fonction de l'amplitude de déplacement de la roue (1b) en direction verticale.

5. Suspension pour véhicule selon l'une des revendications 1 à 4, dans laquelle le dispositif amortisseur de chocs (6) comprend un dispositif amortisseur (6a) qui applique une force de réaction dépendant de la vitesse de déplacement de la roue (1b) en direction verticale.

6. Suspension pour véhicule selon la revendication 5, dans laquelle la suspension est du type à jambe de force et un organe de la jambe est formé par l'amortisseur (6a) qui est fermement fixé à son extrémité inférieure à un support (3) de la roue (1b) afin qu'elle puisse tourner et qui est supporté à son extrémité supérieure sur le châssis (1) du véhicule.

7. Suspension pour véhicule selon l'une des revendications 1 à 6, comprenant en outre une paire de bielles latérales avant et arrière (4a, 4b), chacune d'elles étant raccordée de manière articulée au châssis (1) de véhicule à son extrémité latéralement interne et à un support

(3) de roue destiné à supporter la roue (1b) afin qu'elle puisse tourner, à son extrémité latéralement externe.

8. Suspension pour véhicule selon l'une des revendications 1 à 7, comprenant en outre une paire de bielles supérieure et inférieure destinées à régler le carrossage de la roue (1b).

9. Suspension pour véhicule selon l'une des revendications 1 à 8, dans laquelle le dispositif élastique comprend un dispositif (56) à manchon élastique placé à une extrémité au moins de l'organe de suspension (5).

10. Suspension pour véhicule selon la revendication 9, dans laquelle le dispositif (56) à manchon élastique est placé entre un tube externe (54) formé sur l'organe de suspension et un tube interne (55) supporté par le châssis du véhicule ou un support de la roue afin que celle-ci puisse tourner.

11. Suspension pour véhicule selon la revendication 10, dans laquelle le dispositif (56) à manchon élastique a une cavité (56a) destinée à donner les caractéristiques élastiques.

12. Suspension pour véhicule selon la revendication 10, dans laquelle le dispositif (43) à manchon élastique a un organe rapporté (45) qui est élastiquement plus dur que le dispositif à manchon élastique lui-même si bien qu'il donne les caractéristiques élastiques.

13. Suspension pour véhicule selon la revendication 10, dans laquelle le dispositif à manchon élastique (56) est formé à sa surface externe afin qu'il possède une saillie (56b) qui est contact de la surface interne du tube externe avec une pression prédéterminée et que les caractéristiques élastiques soient obtenues.

FIG.1

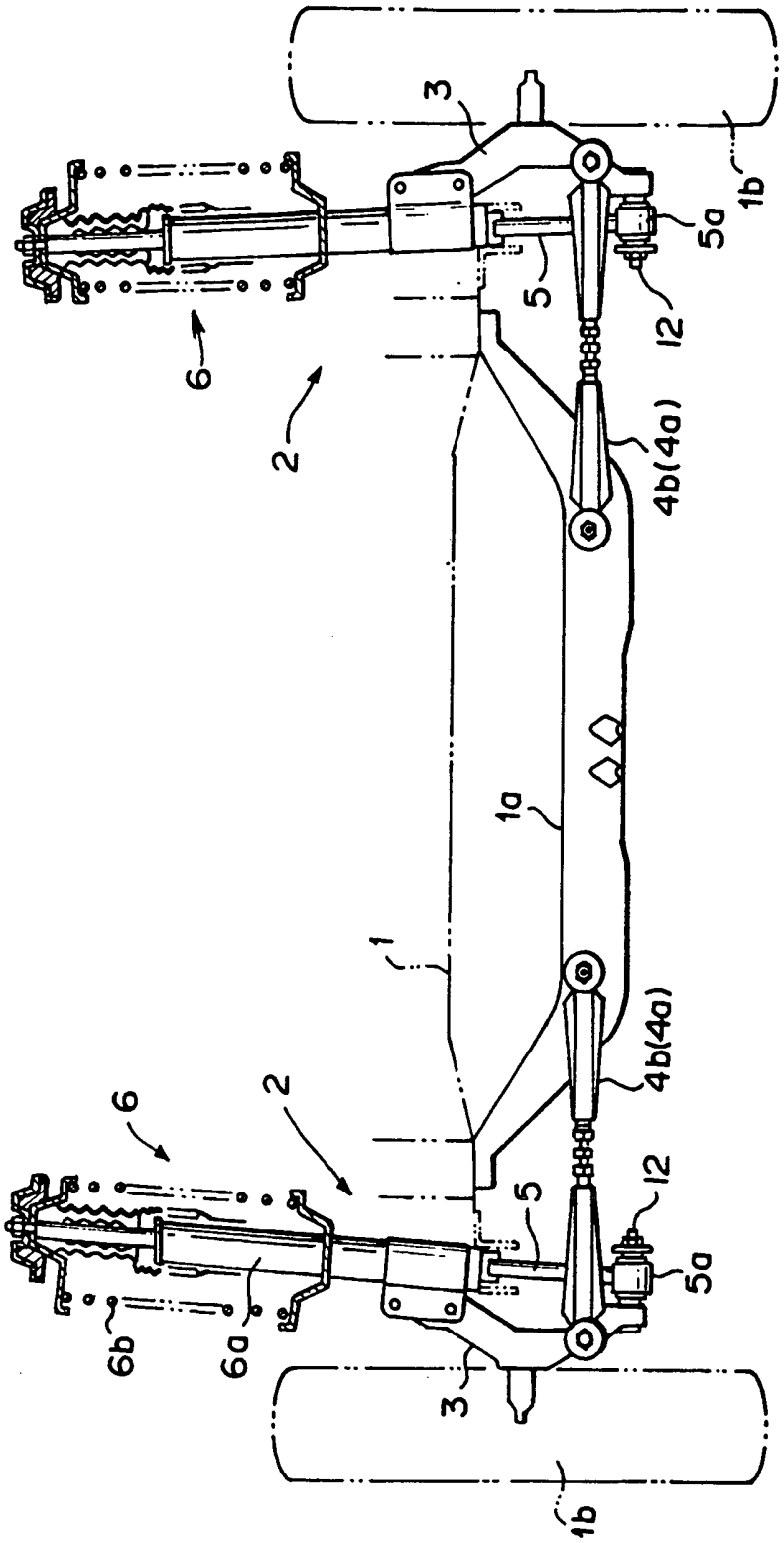

FIG.2

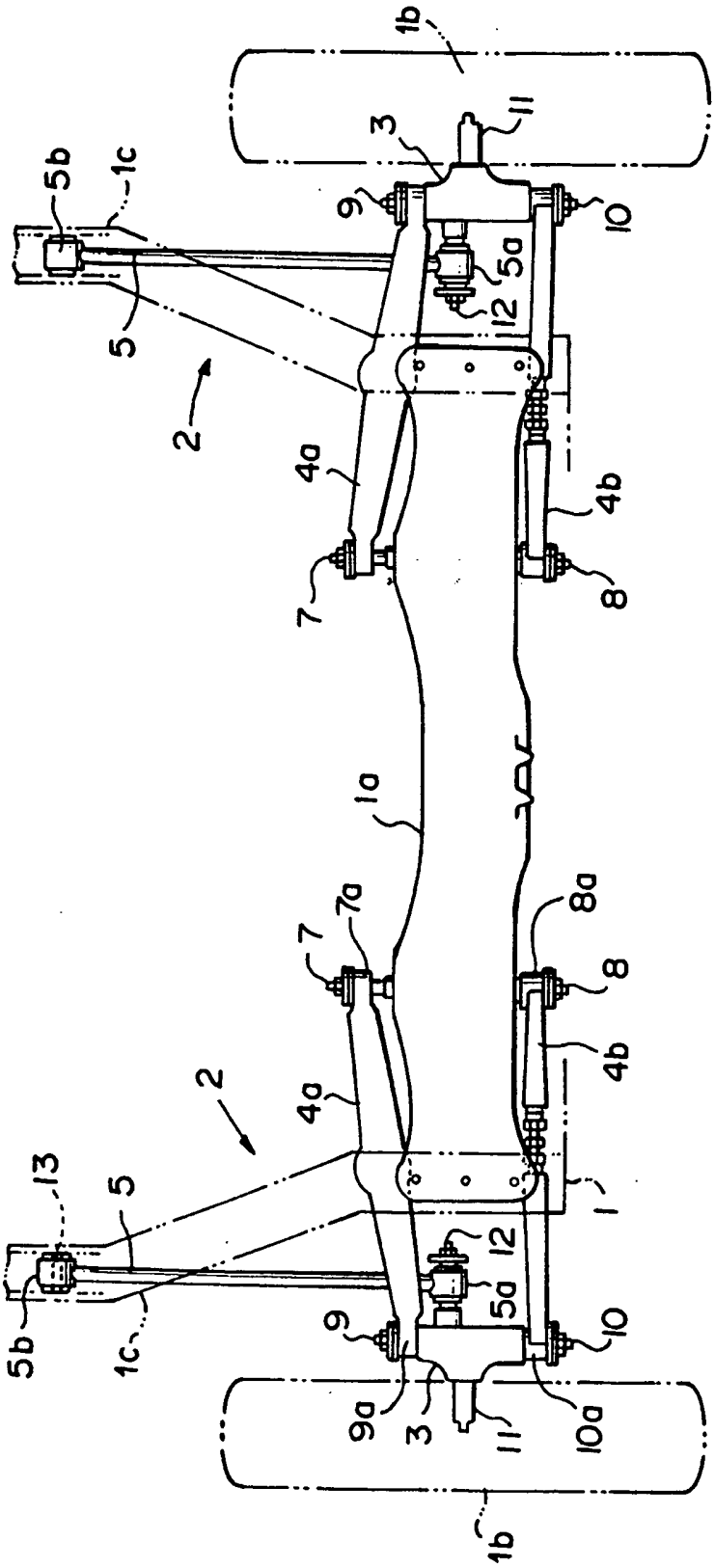

FIG.3

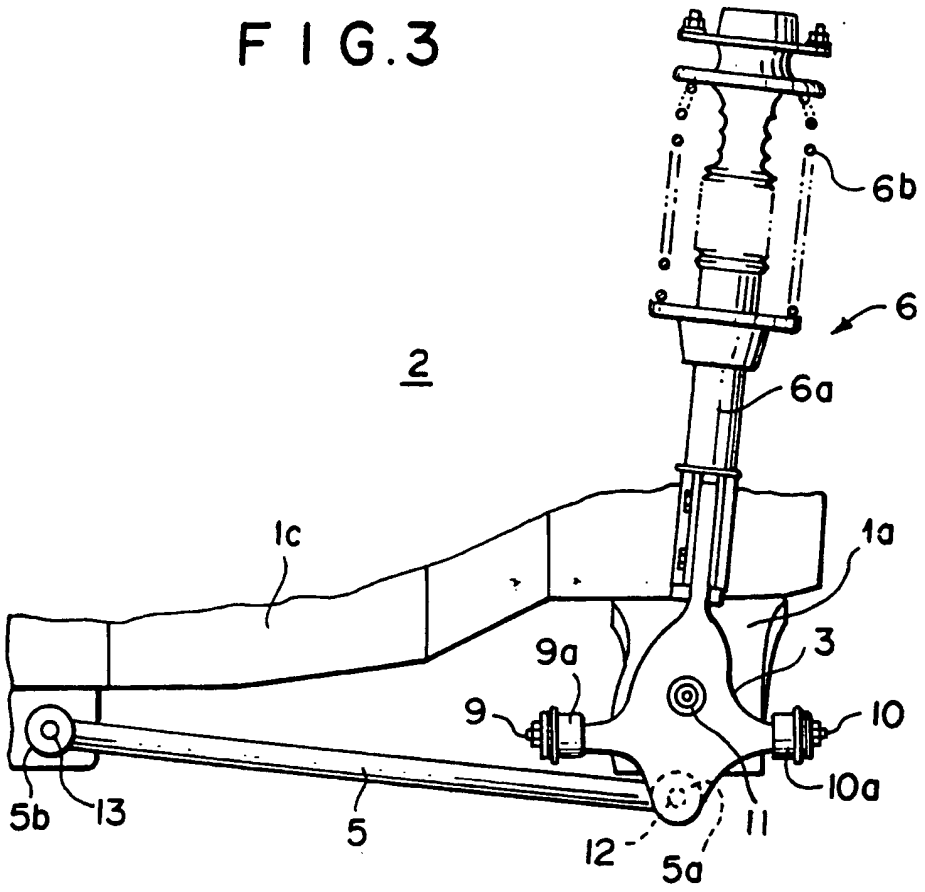
2
6b
6
6a
1c
1a
3
9a
9
10
10a
11
12
5a
5
5b
13

FIG.4

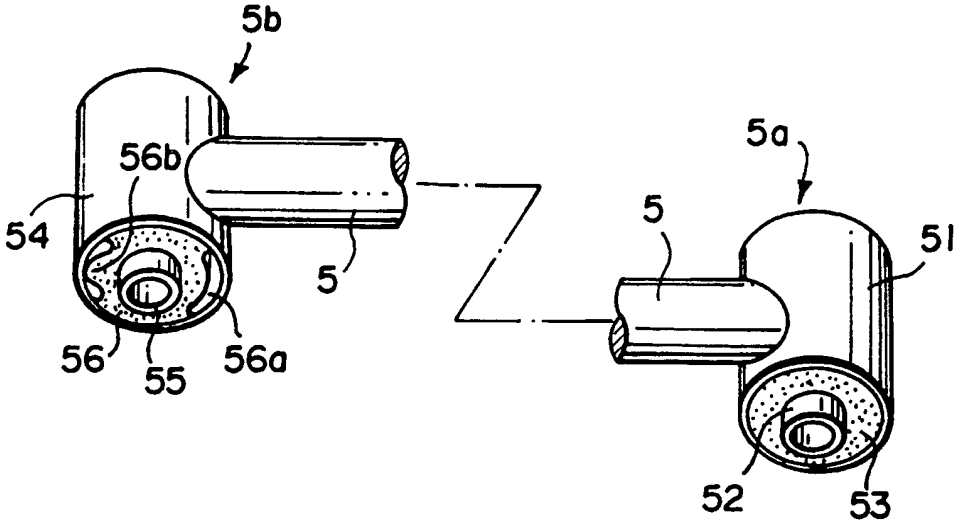
5b
56b
54
5
56
55
56a
5a
5
51
52
53

FIG.5

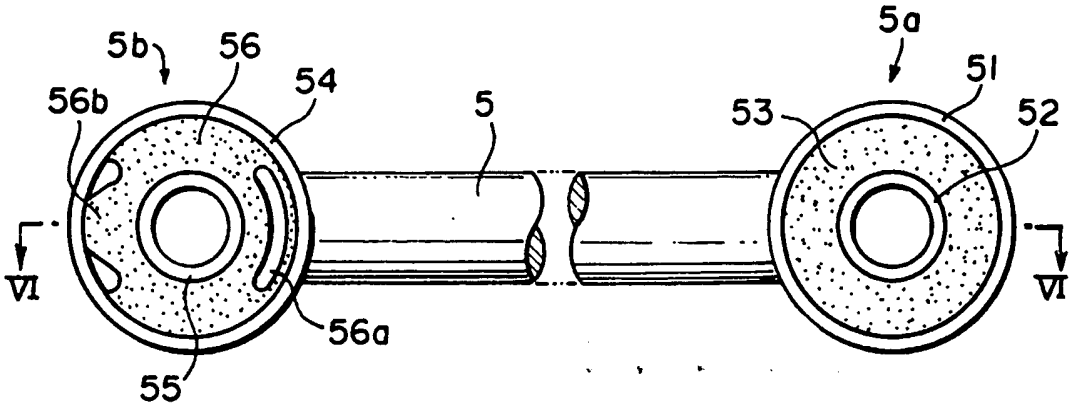
5b
56
54
56b
5
5a
51
53
52
VI
VI
56a
55

FIG.6

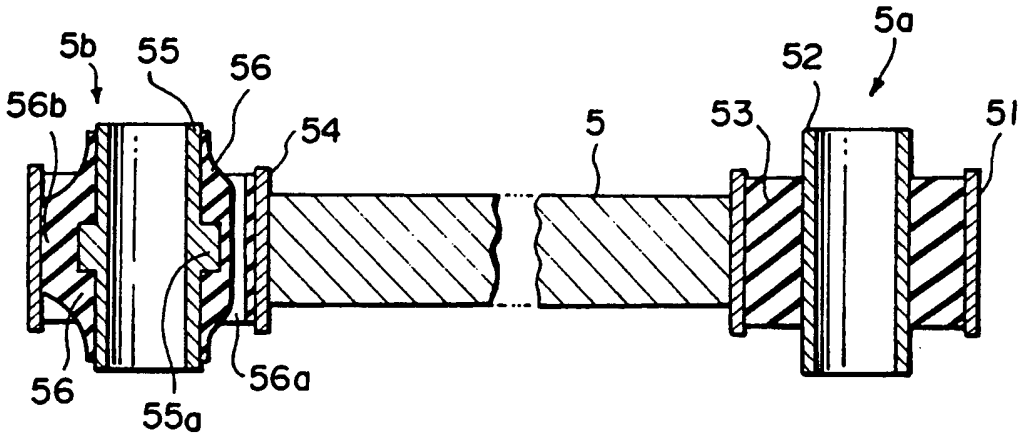
5b
55
56
56b
54
5
5a
52
53
51
56
55a
56a

FIG.7

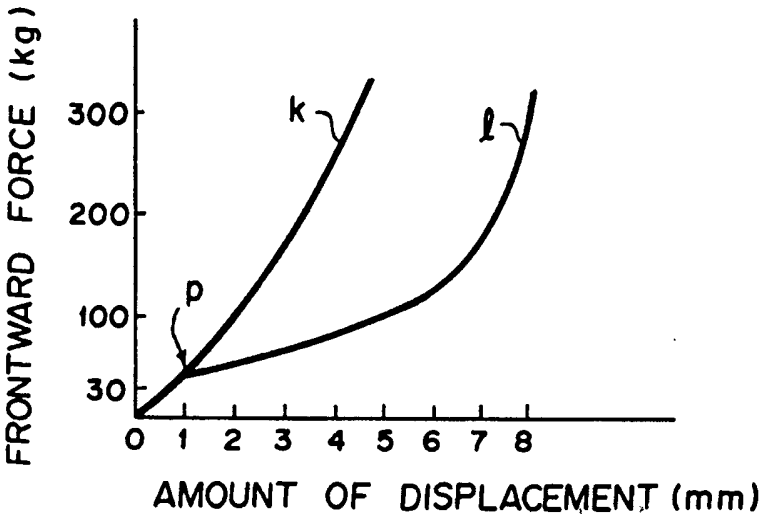
FRONTWARD FORCE (kg)
300
200
100
30
k
l
p
0 1 2 3 4 5 6 7 8
AMOUNT OF DISPLACEMENT (mm)

FIG.8

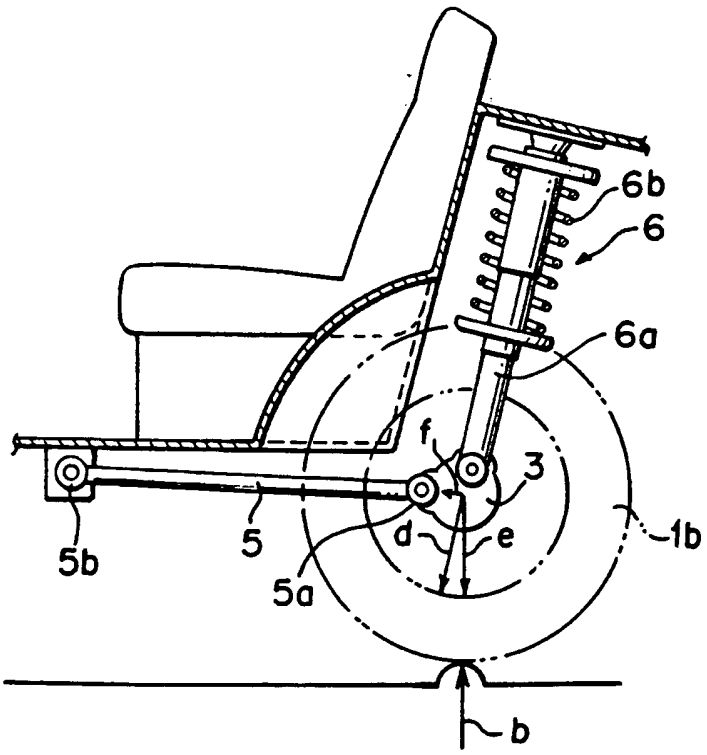
6b
6
6a
f
3
1b
5b
5
d
e
5a
b

FIG.9

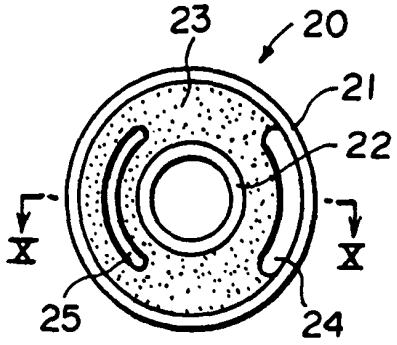

FIG.10

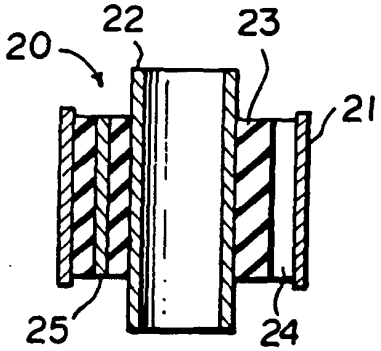

FIG.11

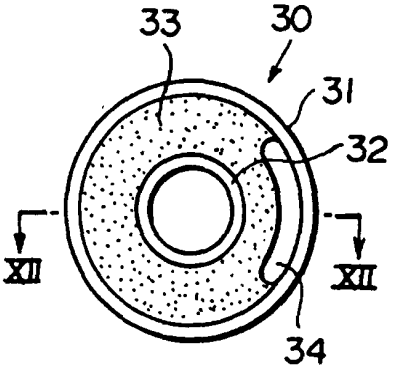

FIG.12

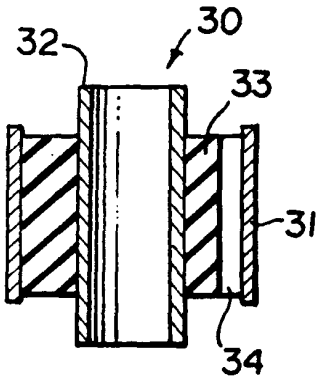

FIG.13

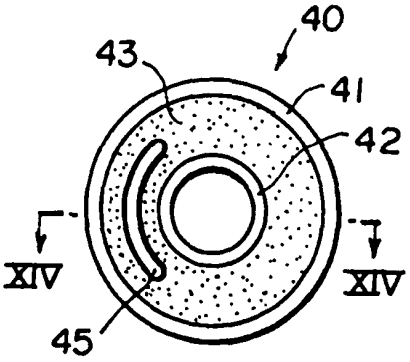

FIG.14

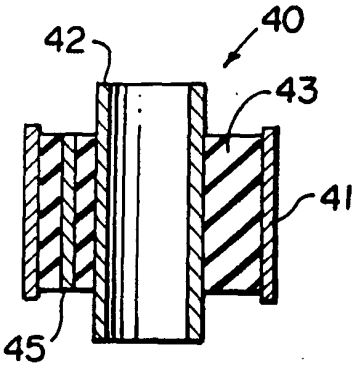

FIG.15

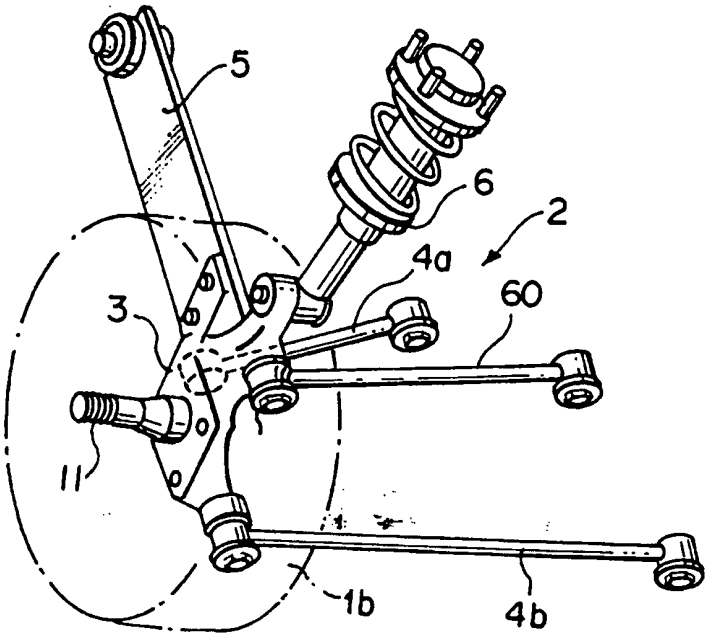

FIG.16